It is the need of the hour to reduce the pollutants which poison our atmosphere and harm our health. The diesel engines are the most efficient IC engines in the world today, but paradoxically, they are also the engines which create the largest amounts of NOx, the pollutant that is most difficult to control with the existing technologies. In fact, the existing technologies are unable to meet the increasingly stringent standards for NOx. Even in bio-diesels, which in the future may be adopted as an important alternative fuel, NOx is the major pollutant. Thus not having a safe and stable method for NOx removal from the diesel exhaust stream is a cause for concern. In this thesis, there has been an attempt to address this issue by means of non-thermal plasma and catalysts.

In this thesis, first the performance of the three sources was evaluated individually, along with two different HV electrodes, a helical wire and a straight wire. Secondly, the efficiencies of these three different types of sources were compared. Thirdly, a catalyst (Red Mud) and an adsorbent (NaZSM5) were cascaded with the plasma reactor to enhance the performance of the NOx removal process with the AC source as it gave the best results. All the experiments were performed with real diesel engine exhaust. The conclusions drawn from the experiments are as follows:

- The helical electrode consumes much lower power than the straight electrode. Therefore it is energy efficient. It also causes corona inception at lower voltages due to the strong non-uniformity of its electric field.
- The drawbacks of the helical electrode are an excess production of NO_2 .it also does not work with the HFAC source, because at high frequency, the voltage doesn't build up owing to the presence of only a dielectric medium of 2 mm thickness between the two electrodes.

- The performances of the 3 sources were compared. The HVAC unit gave the best NOx removal, followed by the MPC and finally, the HFAC source.
- The differences in efficiencies were related to both the magnitude of the peak voltage achieved by each device and the time period. It was also seen that when the voltage was high, a better efficiency can be achieved with lower power consumption.
- The comparison of the sources leads us to conclude that the high voltage AC source can be used as an economic alternative for NOx control. This is because a standard AC unit is easily available at higher voltages, and contains less electrical or mechanical complexity, whereas a pulsed source is comparatively expensive and complex.
- The NaZSM5 zeolite showed excellent removal at room temperature as an adsorbent when cascaded after the AC source, by reducing the NO_2 levels consistently.
- The Red Mud showed reasonable catalytic activity at 400 ^{O}C with the AC source. It was also efficient in compensating for the increase in the NO_2 and CO concentration in the plasma atmosphere.
- Hence, both Red Mud and ZSM 5 are good candidates for a hybrid plasma-adsorbent or plasma-catalyst system.
- The combination better NOx/CO removal is the AC energization coupled with spiral electrode with either ZSM-5 or red mud.

Scaling up the plasma/ plasma- catalyst system for handling higher flow rates will be the main task next. A method to optimize the source and load matching for better power transfer to the plasma reactor from the different sources also need to be developed. The design of the compact high frequency AC source must be upgraded for higher powers.